

Effect of Nursing Protocol on Knowledge and Health Outcomes of Patients undergoing Percutaneous Nephrolithotomy



Esraa Ali Abdallah 1, Madiha Hassan Nabih 2, Mahmoud Anees Bazeed 3 Walaa Nasreldin Othman 4

1 Clinical Instructor, Technical Institution of Nursing, Faculty of Nursing - Mansoura University

2 Assist Professor of Medical Surgical Nursing, Faculty of Nursing - Mansoura University

3 Professor of Urology, Faculty of Medicine - Mansoura University

4 Professor of Medical Surgical Nursing, Faculty of Nursing-Mansoura University

E-mail of corresponding author: esraa_ali93@yahoo.com

ABSTRACT

Background: Kidney stones have been a widespread problem in recent years. Patients with kidney stone disease are prone to several complications and percutaneous nephrolithotomy consider golden stander for the treatment of upper urinary stones, but still has complications. Therefore, patient education is a crucial to decreasing postoperative complications. **Aim:** to evaluate the effect of nursing protocol on knowledge and health outcomes of patient undergoing percutaneous nephrolithotomy. **Method:** A randomized control trial study, sixty patients with kidney stones scheduled for percutaneous nephrolithotomy were assigned into two equal groups of thirty each (study and control) at nephrology and urology center at Mansoura University Hospitals. **Tools:** The study data was gathered using three tools. Tool I: A Structured Interview Questionnaire. Tool II: Patients' Knowledge about Percutaneous Nephrolithotomy. Tool III: Clavien-Dindo grading system for surgical complications classification. Results: Following introduction of the nursing protocol, there was a significant improvement in knowledge within study group in compared to the control group, incidence of complications mean score was statistical significant different between the two groups (0.003), there was significant relation between knowledge level and level of post-operative complications in the study group where $P=0.037$, There was also a statistically significant relationship between the level of postoperative complications and the length of hospital stay in the study group ($P=0.035$). **Conclusion:** After applying nursing protocol, patients undergoing percutaneous nephrolithotomy improved significantly in their knowledge and post-operative health outcomes. **Recommendation:** Nursing protocol should be integrated within the plan of care for renal stone patients undergoing PCNL.

Keywords: Nursing protocol, health outcomes, Kidney stones, percutaneous nephrolithotomy.

Introduction:

Kidney stone (KS) disease is a growing public health problem, that has relation with an increased risk of chronic and end-stage renal disease, most likely resulting from kidney injury caused by obstructive nephropathy (Siener, 2021). The most recent epidemiological studies clearly confirm previous findings of a increasing prevalence of KS worldwide, with rates exceeding 14.8%, and a recurrence rate as high as 50% within the first 5 years following first stone incident (Stamatelou & Goldfarb, 2023).

Urinary tract stone is one of the most prevalent diseases that affects people in all countries. However, the likelihood of producing stones varies significantly around the world. It varies between 1-5% in Asia, 5-9% in Europe, 13% in North America, and 20% in Saudi Arabia. In developed countries, incidence and prevalence rates have been greater, and the trend appears to be increasing in developing countries. Age, gender, dietary habits, fluid intake, climate, occupation, socioeconomic level, hereditary and metabolic

illnesses are all lithogenic factors that differ between countries. (Ganpule, Vijayakumar, Malpani & Desai, 2016). In Egypt, it was reported that the total number of patients with urinary stones was 1266, accounting for 10% of all patients admitted to centers and public hospitals (Mahmoud, Ramadan & Taha., 2019).

Renal stone disease is a common clinical problem in surgical practice. Percutaneous Nephrolithotomy (PCNL) was recommended by all international guidelines for the management of complex and big kidney stones. This is because it achieves the highest single-session stone-free rates (SFR) of all minimally invasive procedures, At the same time, PCNL complications are more common and severe than in other minimally invasive treatment approaches. Patients should be counselled on stone-free and complication rates as part of their preoperative work-up. (El-Nahas et al, 2021).

Percutaneous Nephrolithotomy "PCNL" is indicated for big stones (>2 cm), stones that are difficult to approach endoscopically, and when removing stones in a single surgery is preferable. A contrast imaging study allows for the planning of renal access. The tract is then dilated and a rigid nephroscope is inserted. The stone can be grabbed and removed whole, or it can be shattered in place before being removed. After that, a nephrostomy tube is usually placed into the tract, tamponading it and permitting repeat access if necessary. Injury to surrounding structures during renal access, intra-operative hemorrhage, and infection are all potential complications (Singh, Jha & Thummar, 2022).

Because of their traditional holistic perspective, nurses have considerable expertise in patient education and must take the lead in the administration of the systematic educational measures designed to maintain or enhance the health and achieve goal of a patient who has previously been diagnosed with urolithiasis (Metwally, Abdelaziz, Ghalwash&Mohamed, 2021).

Aim of study:

Evaluate the effect of nursing protocol on knowledge and health outcomes of patient undergoing percutaneous nephrolithotomy.

Research hypotheses:

H₀: Nursing protocol will have no effect on knowledge and health outcomes of patients with renal stones undergoing PCNL.

H₁: Nursing protocol will improve knowledge of patients undergoing PCNL.

H₂: Nursing protocol will improve health outcomes of patients under-going PCNL.

Operational definition: In our study health outcomes includes postoperative complications, length of hospital stay and readmission within thirty days.

Method:

Research design:

Randomized control trial was applied in this research.

Research setting:

The study was carried out at Nephrology and Urology center at Mansoura University Hospitals

Research subjects:

A random sample of 60 adult patients with kidney stones scheduled for percutaneous nephrolithotomy, was randomly divided to two

equal groups of patients: the study group and the control group (30 patients for each).

Tools:

Study's data were obtained using three tools.

Tool I: Structured Interview Questionnaire.

The researcher developed it after researching the relevant literature (Abdelmowla, Hussein, Shahat, Ahmed& Abdelmowla, 2017). This tool involved two parts:

Part I: Demographic information includes name, age, sex, educational degree, and job of the patient.

Part 2: Health relevant data: It concentrated on health history, diagnosis, chief complain, place of stone, stone side, number of stones, chronic diseases, family history, length of hospital stay and readmission within 30 days of patient.

Tool II: Patients' Knowledge about Percutaneous Nephrolithotomy.

This tool was developed by the researcher after reviewing of national and international literatures (Ali, Dessouky& Ebrahim, 2019),(Cacho & Arriola,2021), which includes questions about the percutaneous nephrolithotomy definition, indications, contraindications, medical treatment, preoperative care, postoperative care, postoperative complications, follow up, home care, and discharge instructions "diet, activity, medications, dressing, expected and warning symptoms". The correct answer receives one point, whereas the incorrect answer receives zero points.

Scoring system:

The total score was divided into three categories: 65% to 100% indicated that patients have good knowledge, 50% to less than 65% indicated fair knowledge, and less than 50% indicated that patients have poor knowledge.

Tool III: Clavien-Dindo grading system for surgical complications classification

This tool was developed by (Clavien et al., 1992) then reexamined and modified by (Dindo et al., 2004). It is used to sort out surgical complications depending on experience. Originally, this grading system was based on five different categories of complications that were classified depending on the invasiveness of the intervention and the clinical effect of the complication. Following validation on other surgical procedures, the Clavien classification was modified and further subclassified. The Clavien-Dindo is a common name for the updated system, in the field of urology.

It is used to categorize complications based on life-threatening situations, needed interventions, and disabilities. It consists of:

- **Grade I:** “Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic, and radiological interventions. Allowed therapeutic regimens are: drugs as anti-emetics, antipyretics, analgesics, diuretics, electrolytes, and physiotherapy. This grade also includes wound infections opened at the bedside”.
- **Grade II:** “Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included”.
- **Grade III:** “Requiring surgical, endoscopic or radiological intervention.”
 - Grade IIIa: “Intervention not under general anesthesia.”
 - Grade IIIb: “Intervention under general anesthesia.”
- **Grade IV:** “Life-threatening complication (including CNS complications) requiring IC/ICU management.”
 - Grade IVa: Single organ dysfunction (including dialysis).
 - Grade IVb: “Multiorgan dysfunction.”
- **Grade V:** “Death of a patient”.

Validity of tools

The researcher evaluated the tools' validity to see if they met the aim of the study and to make sure that the standardised booklet was translated correctly. Five medical-surgical nursing professionals were assembled as a jury to review the study tools for content validity, completeness, feasibility, and item clarity.

Reliability

It was utilized to assess how well the employed items conceptually fit together and to determine whether each item on the study tools measures the same variable. Cronbach's Coefficient Alpha test was used to gauge reliability. Both the coefficient values for tools (II) and (III) were reliable at 0.903 and 0.897, respectively.

Pilot research

It was carried out on 10% (6 patients) of the participants to check the tool's clarity, viability and applicability and necessary modifications was done by the researcher accordingly. Patients who

participated in the pilot study were not included in the overall number of study subjects.

Field of work:

1. **Administrative process:** a signed authorization to conduct the study was obtained from Research Ethics Committee of Faculty of Nursing and responsible Nephrology and Urology Center authority affiliated from Mansoura University Hospital, Egypt.
2. **Written informed consent:** Patients' informed consent was gained to take part in the study after being informed of its goals and confidentiality was maintained.
3. **Intervention:** After receiving the necessary consent to carry out the proposed study, the researcher attended the inpatient department, and all participants who met the inclusion criteria were included in the study. The interview took place in a confidential, encouraging environment. The researcher began by introducing herself to the patients and providing a brief description of the study's purpose and design.

Operational phase: Was carried out in the following four phases:

Assessment Phase: Patients that met the inclusion criteria were chosen in order to gather baseline information through: assess demographic data using tool 1(part I), assess health history using tool 1 (part II) and assess patients' knowledge regarding percutaneous nephrolithotomy using tool II.

Planning Phase: Based on assessment phase, the researcher designed the educational program content (booklet and visual materials) in simple Arabic in context with recent literature.

Implementation Phase: The nursing intervention was developed; each patient received a tailored application of the teaching material. Each patient joined two sessions, each session lasts 30 to 45 minutes. A variety of instructional techniques, including brainstorming, lectures, handouts, and the use of visual aids like videos, photographs, and PowerPoint presentations, were used to achieve both general and specific objectives.

The nursing protocol sessions' intended learning outcomes (ILOS) were to: identify PCNL, list indications and contraindications of PCNL, name the components of the renal system and list the function of the kidney. Demonstrate preoperative care for PCNL, postoperative care after PCNL, postoperative complications after

PCNL, and home care and discharge instructions after PCNL.

The intervention sessions were:

Session 1: This session focused on open discussion to clear the study's goal, interventions, and filling the pre-test.

Session 2: The purpose of this session was to ascertain knowledge regarding: renal system components and function of the kidney, kidney stones, causes, risk factors, signs symptoms, complications and treatment modalities, percutaneous nephrolithotomy, definition, indications, contraindications, Preoperative care, postoperative care, postoperative complications after percutaneous nephrolithotomy, home care and discharge instructions following PCNL (medicine, deep breathing and coughing exercises, food, fluid intake and output, activity, expected and warning signs, showering, nephrostomy tube care/dressing, and follow-up visits).

Evaluation Phase:

This phase includes evaluate patient outcome after preoperative educational program using tool II (Patients' knowledge regarding percutaneous nephrolithotomy), tool III (Clavien-Dindo grading system for the classification of surgical complications).

Ethical Considerations

The Mansoura University Faculty of Nursing's research ethics committee gave ethical permission before carrying out the study. All participants were asked for their written or verbal consent before to the study after being informed of its nature and objectives. Each participant had the option of quitting the study at any moment, and participation was completely voluntary. Throughout the entire study, anonymity, privacy, safety, and secrecy were fully guaranteed. The outcome will be incorporated into the required research for a Master's degree, as well as for publications and educational purposes.

Statistical analysis

The most current, valid, and reliable statistical techniques were used for the statistical analysis. Using the Excel application for Windows, the acquired data was coded and entered in a data-based file. To find any errors, frequency analysis and manual review were employed. After full entry, data were translated into SPSS version 17.0, the statistical software for social sciences, where analysis using frequency tables and percentages

was carried out. Numbers and percentages were used to present quantitative data.

Result:

Table (1) shows studied groups distribution rendering to their demographic features, it was noted that (60) patients in all had entered into the research study. More than one thirds (43.3%) of study group and two thirds (60%) of control group were between the ages of 51 and 60 years, their mean age was (46.1 ±9.6 and 46.9 ±11.2) for study and control groups respectively. In terms of gender, two-thirds (60%) of the study group and just under three-quarters (70.0%) of the control group were male. In reference to marital status, two-thirds of the study group (60%) and half (50%) of the control group were married. In terms of education level, (40%) of study group graduated from secondary schools and one third (30%) of control group can read and write. As regards to occupation, more than two thirds (63.3%) of study group and (40 %) of control group have mental work. According to residence, more over half of the study group (56.7%) and nearly three-quarters (70.0%) of the control group lived in rural areas. There was no significant difference between the study and control groups (p-value > 0.05).

Table (2) represents the distribution of the studied groups based on health-related variables. From this table, it was observed that most of study and control group (86.7% and 90%) respectively had renal colic. Regarding previous hospitalization nearly two-thirds (63.3%) of the study group and half (50%) of the control group didn't have previous hospitalization and about three quarters (72.7%) of the study group and two thirds (60%) of control group hospitalized previously due to non-urolological causes. According to family history of stones more than three quarters (76.7%) of study group and two thirds (60%) of control group have a stone-related family heritage. As regards to chronic diseases half (50%) of study group and (70%) of control group have chronic diseases .Around half (46.7%) of study group and three quarters (76.2%) of control group suffering from hypertension. According Stone side two thirds (60%) of study group and half (50%) of control group have stones in their left kidney. According to number of stones slightly less than three-quarters (70%) of the study group and two thirds (60%) of control group have multiple kidney stones.

Figure (1) shows distribution of studied groups based on overall knowledge levels, there was statistical increased in overall levels of knowledge in study group post implementation of

nursing protocol compared to control group ($p < 0.001$).

Table (3): Shows the distribution of the studied groups based on the severity grading of surgical complications; this table illustrated that after implementing the nursing protocol, it is clear that a large number of study group (70%) suffering grade I complications compared to (53.3%) of control group, mainly pain and fever with highly statistically significant difference (0.001). In relation to second grade complication only (23.3%) of study group compared to (40%) of control group suffering grade II complications in which most of control group (91.7%) compared to (42.9%) of study group required more pharmacological treatment with statistical significant different (0.019). Moreover incidence of complications main

score was statistical significant different between study and control groups (0.003).

Figure (2) displays the distribution of studied groups with respect to length of hospital stay; it was found that length of hospital of three fourth (73.3%) of the study group was from one to three days and half (53.3%) of control group was more than three days.

Figure (3) Shows distribution of studied groups according to number of readmissions within 30 days, it was noticed that (43.3%) of the study group readmitted one time and (46.7%) of control group admitted two times

Table3: shows that there was significant relation between knowledge level and level of postoperative complications in the study group post implementing of nursing protocol where $P = 0.037$.

Table 1: Studied Groups Demographic Characteristics (N=60)

	Study group		Control group		Chi – Square / Fisher’s exact test	
	N	%	n	%	X ²	P
Age (years)						
20 – 30	2	6.7	3	10.0		
31 – 40	6	20.0	6	20.0		
41 – 50	9	30.0	3	10.0		
51 – 60	13	43.3	18	60.0	4.006	0.261
Mean ±SD	46.1 ±9.6		46.9 ±11.2		0.309	0.758
Sex						
Male	18	60.0	21	70.0		
Female	12	40.0	9	30.0	0.659	0.417
Marital status						
Single	12	40.0	15	50.0		
Married	18	60.0	15	50.0	0.606	0.436
Educational level						
Can’t read and write	3	10.0	6	20.0		
Read and write	5	16.7	9	30.0		
Primary education	5	16.7	6	20.0		
Secondary education	12	40.0	6	20.0		
University education	5	16.7	3	10.0	4.734	0.316
Occupation						
Mental	19	63.3	12	40.0		
Manual	6	20.0	12	40.0		
None	5	16.7	6	20.0	3.672	0.159
Residence						
Rural	17	56.7	21	70.0		
Urban	13	43.3	9	30.0	1.148	0.284

Table (2): Distribution of Study Groups Depending on Health-Related Variables (N=60)

	Study Group		Control Group		Chi – Square / Fisher’s exact test	
	n	%	n	%	X ²	P
Chief complain						
Renal colic	26	86.7	27	90.0		
Hematuria	4	13.3	3	10.0	0.162	0.688
Previous hospitalization						
Yes	11	36.7	15	50.0		
No	19	63.3	15	50.0	1.086	0.297
If yes, cause of previous hospitalization	(n=11)		(n=15)			
Urological	3	27.3	6	40.0		
Non-urological	8	72.7	9	60.0	0.454	0.500
Family history of stones						
Yes	23	76.7	18	60.0		
No	7	23.3	12	40.0	1.926	0.165
Presence of chronic diseases						
Yes	15	50.0	21	70.0		
No	15	50.0	9	30.0	2.500	0.114
If yes, mention them	(n=15)		(n=21)			
Ischemic heart disease	4	26.7	2	9.5		
Diabetes mellitus	4	26.7	3	14.3		
Hypertension	7	46.7	16	76.2	3.426	0.180
Stone side						
Rt kidney	12	40.0	15	50.0		
Lt kidney	18	60.0	15	50.0	0.606	0.436
Number of stones						
Single	9	30.0	12	40.0		
Multiple	21	70.0	18	60.0	0.659	0.417

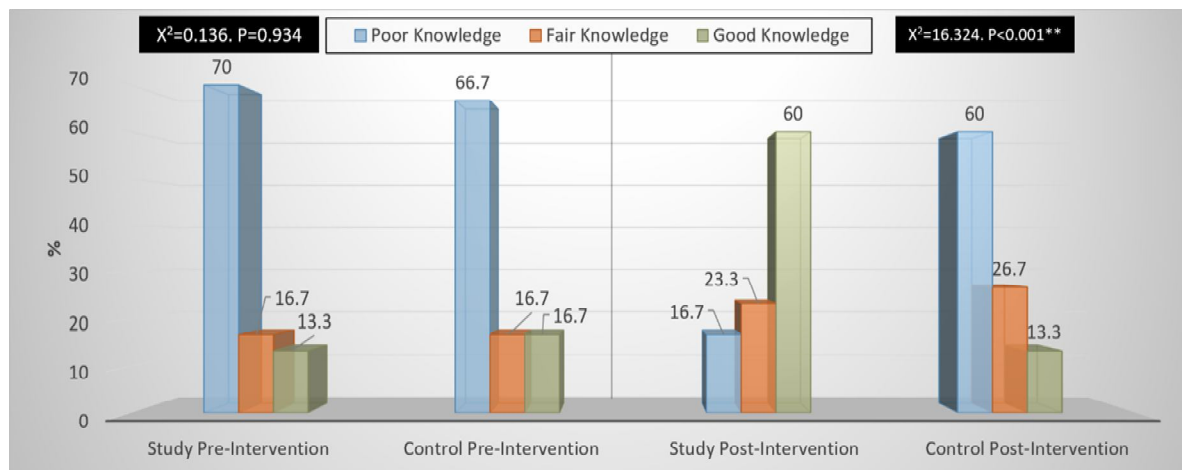


Figure (3): Studied groups Total Knowledge Levels

Effect of Nursing Protocol on Knowledge ...

Table (3). Distribution of the studied groups according to severity grading of surgical complications

	Study				Control				Chi – Square / Fisher’s exact test	
	Yes		No		Yes		No			
	n	%	n	%	N	%	n	%	X ²	P
Grade I	21	70.0	9	30.0	16	53.3	14	46.7	1.762	0.184
Pain	6	28.6	15	71.4	15	93.8	1	6.3	15.718	<0.001**
Fever	6	28.6	15	71.4	15	93.8	1	6.3	15.718	<0.001**
Bleeding not requiring blood transfusion	7	33.3	14	66.7	5	31.3	11	68.8	0.018	0.893
Urine leakage managed by watchful waiting	5	23.8	16	76.2	3	18.8	13	81.3	0.137	0.711
Grade II	7	23.3	23	76.7	12	40.0	18	60.0	1.925	0.165
“Requiring pharmacological treatment with medications other than those indicated for grade I complications.”	3	42.9	4	57.1	11	91.7	1	8.3	5.432	0.019*
“Blood transfusions.”	5	71.4	2	28.6	4	33.3	8	66.7	2.574	0.108
“Total parenteral nutrition.”	0	0.0	12	100.0	0	0.0	12	100.0	0.000	1.000
Grade III										
“Requiring surgical, endoscopic or radiological intervention”	2	6.7	28	93.3	3	10.0	27	90.0	0.218	0.640
Grade IIIa										
“Intervention not under general anesthesia”	1	50.0	1	50.0	2	66.7	1	33.3	0.139	0.709
Grade IIIb										
“Intervention under general anesthesia”	1	50.0	1	50.0	1	50.0	1	50.0	0.000	1.000
	8.9 ±1.8				10.4 ±2.1				3.098	0.003*

Note: t refers to student t test, * refers to significance when $p < 0.05$ ** refers to highly significance if $p < 0.001$

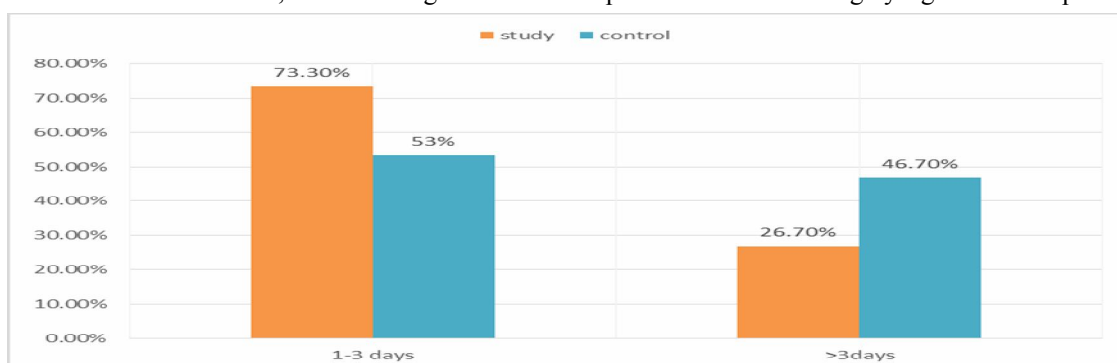


Figure (1): Distribution of the studied groups according to length of hospital stay

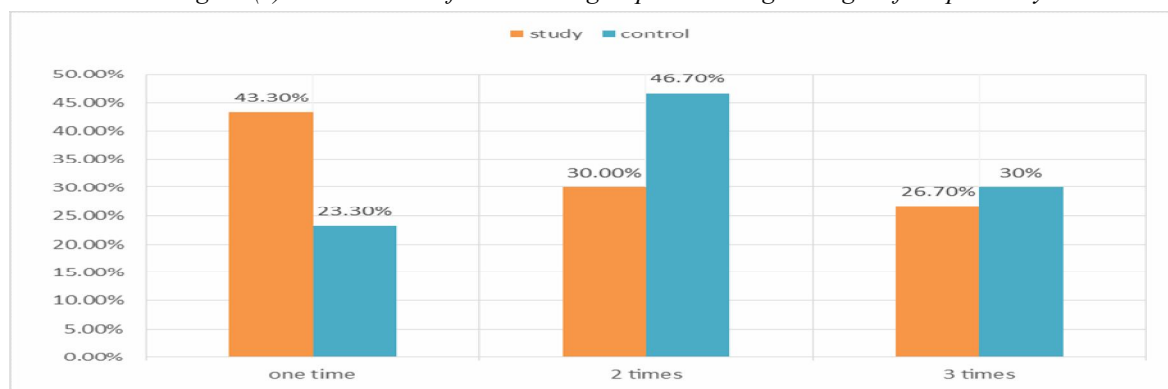


Figure (2): Distribution of the studied groups depending on number of readmissions within 30 days

Table (4) shows the relationship between the patients' total knowledge level and the level of postoperative complications in the control and study groups.

	Complication Score of the Study group	Complication Score of the Control group
	Mean ±SD	Mean ±SD
Knowledge Level		
Poor Knowledge	9.6 ±1.4	10.1 ±2.2
Fair Knowledge	8.9 ±1.9	11.6 ±1.9
Good Knowledge	7.1 ±2.3	9.9 ±0.8
One way ANOVA test		
F	3.722	1.654
P	0.037*	0.210

Note: t refers to student t test, * refers to significance if p < 0.05

Discussion:

Preoperative education is a vital component of nursing care that helps patients understand about their diagnosis, surgery, and postoperative self-care based on their needs, level of knowledge, and patient condition. This is beneficial in reducing complications after surgery and length of stay, as well as improving recovery. (Cheng et al., 2021). Nursing is considered a key component of improving patients' health outcomes. Pre- and post-operative nursing care, in conjunction with health education, is critical to the successful outcome of any surgery (Di Marco et al., 2021).

Demographics of Studied Groups:

According to the current study's findings, the majority of the studied groups were in their fifth decade of life. This finding could be explained by the fact that the prevalence of urolithiasis increases with age. These findings were consistent with the findings of (Li et al, 2022), who conducted a study about "Should we treat asymptomatic concurrent contralateral renal stones; a longitudinal analysis" and indicated that the majority of patients were 49 years old. This finding is also similar with the findings of (Rashid and Yahya ,2018), who revealed that stones affect adults aged 40 to 59. This finding contradicts another study conducted by Luck man et al., 2019), who stated in their book "medical surgical nursing, psychophysiological approach" that urinary stones occurred in early middle adulthood between the ages of 20 and 40. This could be due to the fact that individuals in this age rely on junk food.

The result of the present study revealed that two third of study group and about three quarters of control group were male. Sex differences for kidney stone disease (KSD) may be attributed to sex hormones; Oestrogen promotes a healthy renal environment, which protects against nephrolithiasis. Lower serum testosterone levels

may help preventing women from oxalate stone disease and enhance urinary citrate concentrations.

This result is in line with a study carried out by Gürler& Gündüz (2021) about " Risk factors in urinary stones: A case–control study" reported that, more than two thirds of studied patients (study and control group) were males. This finding is contrast with a study done by (Gillams, Juliebo, Julibo & Somani ,2021) about "Gender Differences in Kidney Stone Disease (KSD): Findings from a Systematic Review" revealed that in the modern era, Females are more prone than males to develop KSD during the course of their lives Determining causation is complicated and further research is needed.

In terms of education and residence, the current findings show that more than one-third of the study group graduated from secondary school, and one-third of the control group can read and write. This finding could be explained by the fact that more than half of the study group and close to three-quarters of the control group resided in rural areas where people made the decision to stop school early to devote more time to agricultural activities. The findings was consistent with (Abd-Elaziz's ,2018) study on the "biochemical relationship between urine composition and urinary stone formation in stone forming patients," which discovered that more than half of the patients tested resided in rural areas and had intermediate level of education.

In respect to occupation, the recent findings revealed that more than two-thirds of the study group and over one-third of the control group have mental work, which may be attributed to the negative relationship between physical activity and renal stones. This finding is congruent with (Khalili et al., 2021) and Ibrahim, Talaat Elshamaa, Hamed Mahmoud, and Sheta, (2022), who discovered that more than half of total individuals (case and control) were office employees.

Health Relevant Data of the Studied Groups:

In the context of patient health history, the results demonstrated that renal colic was the chief complaint of stone illness in the majority of study and control groups. Renal colic used to describe sudden and severe loin discomfort produced by kidney stones obstructing urine flow, resulting in increased pressure on the urinary tract wall. An increase in urinary tract pressure and local blood flow pressure causes the pain mechanism. This result is consistent with the study of (Madaminov & Shernazarov, 2022) about "Causes, symptoms, diagnosis and treatment of kidney stones (urolithiasis)" which found that the patient's symptoms may differ based on the location of the stone, the main symptoms of kidney stones and stones in the upper section of the bladder are paroxysmal discomfort in the back or side under the ribs.

This finding not consistent with finding of study done by Azhar, Kalwar, Akhtar & Altaf , (2022) about "Prevalence of acute renal colic presenting in emergency department of a tertiary care hospital" which reported that side pain/flank pain was seen in one fifth of patients with renal stones.

Concerning family history of stones, the current study exposed that more than three quarters of study group and two thirds of control group have positive family history of stones. These findings may be due to that hereditary factors play a significant role in the formation of kidney stones: 30-60% of persons with kidney stones have a positive family history, and Both twin and genealogical studies revealed that nephrolithiasis is highly heritable (Anderegg, et al. 2023) and according to (Cuellar et al.,2020), this could be related to the impact hereditary factors play in stone formation, as First-degree relatives of stone formers are 2-16 times more likely than the general population to develop kidney stones. In the same line Singh, Harris, Sas & Lieske, (2022) and Safdar et al., (2021) come in accordance with present study results, who reported that Kidney stones are highly heritable and tend to cluster in families.

In regard to past medical history, the results show that half of the study group and about three quarters of the control group have chronic diseases, and around half of the study group and three quarters of the control group of them were suffering from hypertension.

This in the same line with Fahad, Haq, Shahid, Munib& Wahad, (2023) who reported that there was a link between high blood pressure and

kidney stone formation. As a result, hypertension individuals should be regularly watched to make sure that they receive proper therapy to avoid stone formation.

Effect of the nursing protocol on studied groups' knowledge

The current study, illustrates that there was statistical significant difference in patients' knowledge at pre & post implementation phases in the study group. Prior to nursing protocol implementation, both groups' knowledge levels were equal. More than two-thirds of the study and control groups, respectively, had poor knowledge level pre implementation of nursing protocol; this could be attributed to the large proportion of studied sample graduated from secondary school or that; the majority didn't receive adequate information from healthcare personnel. As well as it could be due to limited time of health care providers or lack of awareness of the need to do so.

While, knowledge level significantly increased in study group compared with control group post implementing nursing protocol, It indicates that the intervention was successful and the first hypothesis was proven, this reflects that implementation of nursing protocol affected positively on patients' knowledge and This might be due to the researcher's effort to communicate the necessary information to patients in the study group simply by using the relevant teaching materials, simple language, suitable educational methods, and instructional media.

This finding aligned with the findings of (Ibrahim et al., 2022) and "Mohammed Abd El Guid, Mosaad Ali, and Elsayed Ghoneem., 2023" who discovered that The majority of the study group had satisfactory knowledge following educational guidelines, whereas the majority of the control and study groups had insufficient knowledge prior to educational guidelines.

Also, these results were coordinated with (Gonella et al., 2021) who identified that postoperative educational intervention was associated with improved patient knowledge.

The findings of the study opposed with (Jamnadass et al., 2018) who conducted online research "The Role of Social Media and Internet Search Engines in Information Provision and Dissemination to Patients with Kidney Stone Disease: A Systematic Review from European Association of Urologists Young Academic Urologists" and found that, more than half of the studied patients had poor knowledge of kidney disease. This could be related to disease, which

prompted them to seek and receive information from their caring nurse and doctor.

Effect of nursing protocol on incidence of complications in studied groups

Regarding the incidence of complications, the current study found that incidence of complications mean score was statistically different between the two groups after implementing the nursing protocol, This finding could be attributed to the study group's improved understanding and adherence to the nursing protocol and having good knowledge regarding preoperative care for PCNL, Postoperative care after PCNL and postoperative complications after PCNL. This may rendered gaining higher level of knowledge allowing patient to better comply and manage their care. So, Our study confirm that preoperative health education should be a standard component of routine care for PCNL patients.

Study by Klaiber et al, (2018) and Abd ElGwadElkalashy& Masry, (2018) confirmed that Patient education is an essential component of nursing care. Which increases patients' competence, confidence, and self-efficacy and empowers them to take an active role in their care, reducing postoperative complications and mortality.

According to the current study, the majority of the study and control groups suffered from grade I-II (minor) complications, whereas the minority of both groups suffered from grade III (major) complications. There were no grade IV or V complications detected. These findings were strongly confirmed by (Tzelves et al, 2021) who observed that the majority of patients had Clavien I-II (minor complication) while a minority had Clavien III-IV (major problem).

The current study found no statistically significant changes in grade II between the study and control groups. These findings were consistent with those of (Campagna et al., 2020) who discovered that preoperative education has no impact on outcomes such as life-threatening complications and death. In Grade I complications transient fever occurred in half of patients treated with antipyretics. These findings were in the same line with Asif, Farooq, Ullah, Azam & Bibi (2023) who revealed that Clavien grade I was the most frequently occurring complication. The Clavien grade III complication noted in (9%) of the individuals required surgery or radiological interventions.

Regarding to pain, this research discovered a statistically significant difference between the study and control groups. This could be attributed to the effect of the nursing protocol, in which patients in the study group demonstrated deep breathing exercises that had a beneficial effect on pain. (deep breathing can help improve ability to cope and control the pain), this is in the same line with (Mohamed, Abdallah, Mehany & Mahgoub, 2022) and (Mathai& Susila, 2023) who stated that, There is a significant statistical difference in the grade of pain between the study and control groups; this finding was confirmed by (Campagna et al., 2020) and (Koivisto et al., 2020), who indicated that formal preoperative education had inconclusive positive effects on pain.

Regarding to fever, this study revealed a statistically significant difference between the study and control groups. These findings were matched with Saltirov & Petkova (2020) who carried out in their study about "Complications related with PCNL and their management" and reported that overall postoperative fever rate was 10.4%."

Concerning second grade complication only one fifth of study group compared to two fifth of control group suffering grade II complications in which most of control group compared to minority of study group required more pharmacological treatment with statistical significant different. These findings are consistent with the findings of (Abdelmowla et al., 2017), who found that Grade II complications were significantly higher in the control group than in the study group. This can be explained by the impact of nursing interventions and patient education on the study group.

As regard to length of hospital stay (LOS), the present study revealed that length of hospital stay of about three fourth of the study group was from one to three days and half of control group was more than three days, this may be interpreted that study group has less complication than control group. This finding is in agreement with (Yeo & Park, 2023) who reported that Compared with the control group, the intervention group participants had shorter hospital stays. This finding is also in line with a recent analysis of Canadian Institute for Health Information data, which revealed an average LOS of 4.19 days for PCNL (Krocak, Pace, Andonian, & Beiko, 2018), which could be attributed to insufficient health education.

Also (MacDonald, M. et al., 2022) conducted study entitled "Effect of tranexamic acid on bleeding outcomes after percutaneous

nephrolithotomy: A systematic review and meta-analysis of randomized controlled trials” and stated that the average LOS for both experimental and control groups was 3.6 days, with a range of 2.4 to 4.7 days. (Ichaoui et al., 2019) revealed that the average length of hospital stay was 3.81 days. Variations in center-to-center protocols regarding keeping patients admitted may contribute to a wide range of LOS after PCNL.

Regarding number of readmissions within 30 days more than two fifth of the study group readmitted one time and slightly less than half of control group admitted two times, and this is supported by Cacho & Arriola , (2021) conducted study entitled “Health education intervention for patients undergoing placement of percutaneous nephrostomy tube: a randomized controlled trial” and stated that When compared to control group subjects, participants who received the educational intervention had fewer urgent (unscheduled) visits.

The relation between total knowledge score and incidence of complications:

According to the current study, in the study group patients with poor knowledge had the highest complications score, whereas patients with good knowledge had the lowest complications score. The differences in complications scores between knowledge levels were significant, which can be explained by the fact that a lack of knowledge regarding medications, diet, wound care, rest, and activity can lead to a lot of complications. And this confirms that effective instruction via educational guidelines improves patients' knowledge, resulting in fewer complications. As a result, patients who have had percutaneous nephrolithotomy require education to assist them avoid many postoperative complications and enhance their health outcomes.

These findings were reinforced by (Klaiber et al., 2018) and (Ahmed et al., 2019) who recognized that postoperative patient education is an important part of nursing care that helps patients take care of themselves after they discharge from hospital, resulting in less post-operative complications. Furthermore, as reported by (Adugbire and Aziato 2018), effective supportive education provides patients with the information and practices they need to understand their condition, surgery, and recovery; prevent and manage postoperative complications; and reduce hospital readmission, morbidity, and mortality rates.

Finally, this study emphasizes the importance of incorporating education into the management of renal stone disease by all health professionals, including nurses, where acquiring knowledge and skills can lead to an increase in patients' knowledge that is required for the maintenance or improvement of health.

Conclusion:

Patients undergoing percutaneous nephrolithotomy demonstrated a significant increase in their knowledge after receiving the nursing protocol.

Based on the study's findings, the following recommendations have been suggested:

- Nursing protocol should be integrated within the plan of care for renal stone patients undergoing PCNL.
- Establishment of an educational unit for renal stone patients) for urinary tract stone patients)in the nephrology and urology hospital.
- A continuous educational programs for urolithiasis patients should be designed and delivered on a regular basis in the urology department and outpatient clinic.
- A printed copy of an Arabic booklet with simple language and images should be made available and distributed to patients planned of having PCNL.
- Nurses should be taught about the importance of patient educations to reduce morbidity and mortality.
- A workshop for nurses will be organized to update nurses who caring patient undergoing percutaneous nephrolithotomy on the most recent nursing protocol on renal stone disease and PCNL procedure.
- Additional research on a larger probability sample is recommended to allow for generalization and to broaden the usage of nursing protocol.

References

- Abd El GwadElkalashy, R., & Masry, S. (2018).** The effect of preoperative educational intervention on preoperative anxiety and postoperative outcomes in patients undergoing open cholecystectomy. *BJU Int*, 117(1), 62-71.
- Abdel-Aziz E. (2018).** Biochemical relationship between urine composition and urinary stone formation in stone forming patients, *Journal of urology*, 16(3): 382-3.

- Abdelmowla, R. A. A., Hussein, A. H., Shahat, A. A., Ahmed, H. A., & Abdelmowla, M. A. A. (2017).** Impact of nursing interventions and patients education on quality of life regarding renal stones treated by percutaneous nephrolithotomy. *Journal of Nursing Education and Practice*, 7(12), 52-63.
- Ahmed, H. A., Mohammad, Z. A. E. L., Abdelmaged, E. S., Shahat, A. A., & Abdalla, M. A. (2019).** Effect of nursing teaching guideline on patient anxiety before radical nephrectomy at Assiut university hospital. *Assiut Scientific Nursing Journal*, 7(19), 82-91.
- Anderegg, M. A., Olinger, E. G., Bargagli, M., Geraghty, R., Pohlmeier, L., Nater, A., Bruggmann, R., Saye, J. A., Vogt, B., Schalle, A. & Fuster, D. G. (2023).** Prevalence and characteristics of monogenic disease in Adult Kidney Stone Formers. 2023-07. doi:10.1101/2023.07.23.23292924.
- Asif, M., Farooq, K., Ullah, M. I., Azam, A., & Bibi, R. (2023).** Complications Rate of Conventional Percutaneous Nephrolithotomy (PCNL) in a tertiary care center. *Pakistan Journal of Medical & Health Sciences*, 17(04), 111-111.
- Azhar, M., Kalwar, M. T., Akhtar, N., & Altaf, A. (2022).** Prevalence of acute renal colic presenting in emergency department of a tertiary care hospital. *Rawal Medical Journal*, 47(1), 152-152.
- Cacho, L. M. F., & Arriola, R. A. (2021).** Health education intervention for patients undergoing placement of percutaneous nephrostomy tube: a randomized controlled trial. *Journal of Wound Ostomy & Continence Nursing*, 48(4), 307-310.
- Campagna, S., Clari, M., Delfino, C., Rolfo, M., Rizzo, A., Berchiolla, P., & Ferrero, A. (2020).** Impact of a preoperative video-based educational intervention on postoperative outcomes in elective major abdominal surgery: A randomized controlled trial. *Journal of Gastrointestinal Surgery*, 24, 2295-2297.
- Cheng, J. Y. J., Wong, B. W. Z., Chin, Y. H., Ong, Z. H., Ng, C. H., Tham, H. Y., Samarasekera, D. D., Devi, K. M. & Chong, C. S. (2021).** Preoperative concerns of patients undergoing general surgery. *Patient Education and Counseling*, 104(6), 1467-1473.
- Clavien, P. A., Sanabria, J. R., & Strasberg, S. M. (1992).** Proposed classification of complications of surgery with examples of utility in cholecystectomy. *Surgery*, 111(5), 518-526.
- Cuellar C., Wang P., Freundlich M., Filler G. (2020):** Educational review: role of the pediatric nephrologists in the work- up and management of kidney stones. *Pediatric Nephrology*, 35:383-397
- Di Marco, F., Pani, A., Floris, M., Martini, A., Dell'Antonio, G., Capitanio, U & Trevisani, F. (2021).** Unexpected Outcomes of Renal Function after Radical Nephrectomy: Histology Relevance along with Clinical Aspects. *Journal of clinical medicine*, 10(15), 3322.
- Dindo, D., Demartines, N., & Clavien, P. A. (2004).** Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Annals of surgery*, 240(2), 205.
- El-Nahas, A. R., Nabeeh, M. A., Laymon, M., Sheir, K. Z., El-Kappany, H. A., & Osman, Y. (2021).** Preoperative risk factors for complications of percutaneous nephrolithotomy. *Urolithiasis*, 49(2), 153-160.
- Fahad, S., Haq, M. U., Shahid, M., Munib, S., & Wahad, F. (2023).** Investigating Risk Factors for Kidney Stones in Department of Nephrology Saidu Teaching Hospital Swat. *Pakistan Journal of Medical & Health Sciences*, 17(05), 317-317.
- Ganpule, A. P., Vijayakumar, M., Malpani, A., & Desai, M. R. (2016).** Percutaneous nephrolithotomy (PCNL) a critical review. *International Journal of Surgery*, 36, 660-664.
- Gillams, K., Juliebø-Jones, P., Juliebø, S. Ø., & Somani, B. K. (2021).** Gender differences in kidney stone disease (KSD): findings from a systematic review. *Current urology reports*, 22, 1-8.

- Gonella, S., Delfino, C., Rolfo, M., Rizzo, A., Esposito, V., Berchiolla, P., & Campagna, S. (2021).** Effects of a video-based preoperative educational intervention plus nurse-led reinforcement discussion on knowledge, self-efficacy, and resilience in patients undergoing major surgery. *Clinical Nursing Research*, 30(6), 753-761.
- Gürler, H., & Gündüz, E. S. (2021).** Risk factors in urinary stones: A case-control study. *International Journal of Urological Nursing*, 15(3), 117-122.
- Ibrahim, A. E. F., Talaat Elshamaa, E., Hamed Mahmoud, M., & Sheta, A. E. S. (2022).** Effect of Educational Guidelines Prior Nephrolithotripsy on Patients' Performance and Satisfaction. *Journal of Nursing Science Benha University*, 3(2), 728-744.
- Ichaoui, H., Samet, A., Hadjalouane, H. B., Hermi, A., Hedhli, H., Bakir, M. A., Khiari, R & Gozzi, S. (2019).** Percutaneous nephrolithotomy (PCNL): standard technique versus tubeless-125 procedures. *Cureus*, 11(3).
- Jamnadass, E., Aboumarzouk, O., Kallidonis, P., Emiliani, E., Tailly, T., Hrubby, S., ... & Somani, B. K. (2018).** The role of social media and internet search engines in information provision and dissemination to patients with kidney stone disease: a systematic review from European association of urologists young academic urologists. *Journal of Endourology*, 32(8), 673-684.
- Khalili, P., Jamali, Z., Sadeghi, T. (2021).** Risk factors of kidney stone disease: a cross-sectional study in the southeast of Iran, *BMC Urol*, 21 (141). [https://doi. Org/10.1186/s12894-021-00905-5](https://doi.org/10.1186/s12894-021-00905-5).
- Klaiber, U., Stephan-Paulsen, L. M., Bruckner, T., Müller, G., Auer, S., Farrenkopf, I., ...**
- Klaiber, U., Stephan-Paulsen, L. M., Bruckner, T., Müller, G., Auer, S., Farrenkopf, I& Knebel, P. (2018).** Impact of preoperative patient education on the prevention of postoperative complications after major visceral surgery: the cluster randomized controlled PEDUCAT trial. *Trials*, 19, 1-12.
- Koivisto, J. M., Saarinen, I., Kaipia, A., Puukka, P., Kivinen, K., Laine, K. M., & Haavisto, E. (2020).** Patient education in relation to informational needs and postoperative complications in surgical patients. *International journal for quality in health care*, 32(1), 35-40.
- Li, S., Quarrier, S., Serrell, E. C., Penniston, K. L., & Nakada, S. Y. (2022).** Should we treat asymptomatic concurrent contralateral renal stones? A longitudinal analysis. *Urolithiasis*, 1-7.
- Luck man N., Black M., Jacobs M., and Sorensen S. (2019).** Medical surgical nursing, psychophysiological approach, 4th ed, Philadelphia, W.B Saunders Co, 1475-77.
- MacDonald, M., Ilie, G., Power, L., Whalen, S., Parker, R., Skinner, T. A., & Powers, A. G. L. (2022).** Effect of tranexamic acid on bleeding outcomes after percutaneous nephrolithotomy: A systematic review and meta-analysis of randomized controlled trials. *Journal of Endourology*, 36(5), 589-597.
- Madaminov, M., & Shernazarov, F. (2022).** Causes, symptoms, diagnosis and treatment of kidney stones (urolithiasis). *Science and Innovation*, 1(8), 760-765.
- Mathai, M., & Susila, C. (2023).** An Experimental study: Effectiveness of Nursing protocol on postoperative outcome among patients undergoing major Visceral Surgeries in a Selected Tertiary Care Hospital at Delhi. *International Board*, 15(3), 37.
- Mohamed, D. A., Abdallah, A. K., Mehany, M. M., & Mahgoub, A. A. (2022).** Effect of implementing nursing guidelines on reduction of acute Complications for patient with Percutaneous nephrostomy admitted to emergency unit. *Assiut Scientific Nursing Journal*, 10(32), 218-230.
- Mohammed Abd El Guid, S., Mosaad Ali, M., & Elsayed Ghoneem, S. (2023).** Effect of Evidence Based Guidelines on Health Outcomes among Patients Undergoing Extracorporeal Shock Waves Lithotripsy for Urolithiasis. *Journal of Nursing Science Benha University*, 4(1), 1-23.
- Rashid, A. O., & Yahya, M. M. (2018).** Percutaneous Nephrolithotomy in Obese Patients, Is There Any Challenge? *Open Journal of Urology*, 8(2), 49-58.

- Safdar O., Alzahrani W., Kurdi M., Ghanim A., Nagadi S., Alghamdi S., Zaher Z., & Albokhari M. (2021).** The prevalence of renal stones among residents in Saudi Arabia. *Journal of Family Medicine and Primary Care*, 10 (2): 974- 977
- Saltirov, I., & Petkova, K. (2020).** Complications related with PCNL and their management. Percutaneous nephrolithotomy, 103-112.
- Siener, R. (2021).** Nutrition and kidney stone disease. *Nutrients*, 13(6), 1917
- Singh, H., Jha, A. K., & Thummar, H. G. (2022).** Complications in Mini PCNL. In *Minimally Invasive Percutaneous Nephrolithotomy* (pp. 305-322). Singapore: Springer Singapore.
- Singh, P., Harris, P. C., Sas, D. J., & Lieske, J. C. (2022).** The genetics of kidney stone disease and nephrocalcinosis. *Nature Reviews Nephrology*, 18(4), 224-240.
- Stamatelou, Kyriaki, and David S. Goldfarb.** "Epidemiology of kidney stones." In *Healthcare*, vol. 11, no. 3, p. 424. MDPI, 2023.
- Tzelves, L., Geraghty, R., Mourmouris, P., Chatzkrachtis, N., Karavitakis, M., Somani, B., & Skolarikos, A. (2022).** Shockwave lithotripsy complications according to modified Clavien-Dindo grading system. A systematic review and meta-regression analysis in a sample of 115 randomized controlled trials. *European Urology Focus*, 8(5), 1452-1460.
- Yeo, H., & Park, H. (2023).** Benefits of a Single-Session, In-Hospital Preoperative Education Program for Patients Undergoing Ostomy Surgery: A Randomized Controlled Trial. *Journal of Wound, Ostomy and Continence Nursing*, 50(4), 313-318.